Photovoltaics for Affordable and Cooperative Housing

CLEAN RENEWABLE POWER FROM THE SUN

Muir Commons Cohousing with 10k PV system , Davis, CA

Contents:

- **Description of Photovoltaic technology**
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For affordable and Cooperative Housing Developers

Published April 2003

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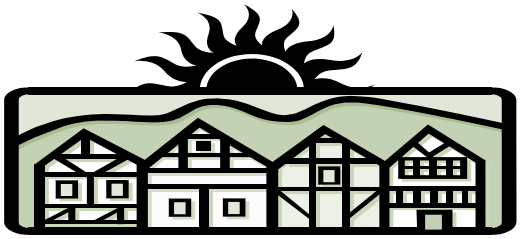


INTRODUCTION

Non-profit housing developers have an incredible task when they bring together the many financing, construction, leasing, and community support elements needed for a successful low-income housing project. Photovoltaics (PV) is an established technology that may play an important role in this balancing act.

The key benefit of including PV in an affordable housing project is that it lowers the long-term operating costs of the project owners or renters. Since low and very low-income households pay disproportionately high percentage of their income on utilities (15%-25% compared to 4%-5%), a consistently free source of power (the sun) can have a significant long-term benefit. PV also provides insurance against rapidly increasing and volatile electricity costs.

Another strong reason to include PV in low-income housing projects is that current government incentives are making the equipment affordable – with payback periods of under 10 years becoming common.

Finally, the technology has social and environmental benefits and its deployment at every economic level will serve to further its market growth. When clean, renewable energy becomes the norm rather than the exception in new construction projects, California will be

on its way toward a healthy, dependable and stable energy supply.

Information on renewable energy strategies, technology and products are finding their way into the signature blueprints of many new buildings, whether small or large, residential and commercial. Opportunity also abounds for energy saving renovations of existing buildings.

Technology for daylighting, passive solar space conditioning, solar hot water systems, building-integrated photovoltaics, and solar ventilation pre-heat are making a noteworthy impression on the preservation of our natural resources. Today's conservation efforts will continue to impact our planet for generations to come.

This booklet was written to assist affordable housing builders and owners in the PG&E utility area to incorporate PV into a new or existing residential building. Most of the information will be useful for housing built elsewhere in California. However, affordable housing organizations operating outside the PG&E service territory should consult their local power provider on issues of rebates, net-metering applications, funding support and financing programs.

The Solar for Affordable Housing project was funded by the California Energy Commission and Pacific Gas and Electric Company. The booklet is a project of the Twin Pines Cooperative Foundation.

IMMEDIATE BENEFITS OF A PV SYSTEM FOR AN AFFORDABLE HOUSING PROJECT

Whether you are building a new project or have existing apartments or homes to retrofit, photovoltaics is a sound investment:

1. Reduce long-term operation costs

A PV project will reduce the long-term operations budget for the facility by lowering the electricity costs for the next 30-40 years. The electricity rates in California have increased dramatically, and future costs and prices are volatile. A PV system is a safety net against higher electricity rates because the cost per kWh produced goes down as the price of the PV system is "earned" through clean power production over time. Also, a PV system is maximizing power production during the peak demand periods of the day – thereby reducing the facilities' peak demand rate.

2. Including PV in new construction makes the system even more affordable

A PV project is most affordable and the payback period is the shortest when the cost is built into a long-term construction loan and mortgage financing. Also, planning the system during construction reduces the cost of above ground installation, trenching and laying underground conduit.

3. Reliability

There are a wide range of system options and the sources

of equipment and installation services are available to meet any need. Project managers should expect to receive competitive bids from qualified PV installers. Most PV modules have a 10-25 year warranty (depending on manufacturers). The systems are now more efficient and they require very little maintenance.

4. Maximum financial incentives available

There is currently a special rebate fund for PV projects on affordable housing. This special funding and the current net-metering laws make this a good time to invest in PV.

5. Environmental and Social Benefits

Finally, the environmental benefits of installing a PV system are highly significant, and a PV project would make a strong statement to the community about the importance of reducing environmental impact. Many local governments are promoting renewable power technology, and integrating PV into a project may help generate political and community support for the project.

A NOTE ABOUT KW AND KWH

Before you read how photovoltaics produces electricity, its useful to understand the terms to describe electricity use and production.

Electricity use is measured in terms of watts over time, or kilowatt hours (kWh.) A kWh is equivalent to one-thousand watts used for an hour. To grasp the amount of power this represents, it is sometimes helpful to imagine ten 100 watt light bulbs running for an hour.

The size of a Photovoltaic system is described by the number of watts the system could produce, based on factory ratings. For example, a twenty-five-hundred watt system (with 2,500 watts of PV panels, and a 2,500 watt inverter) would be called a 2.5kw system. KW is the term for kilowatts, or one thousand watts.

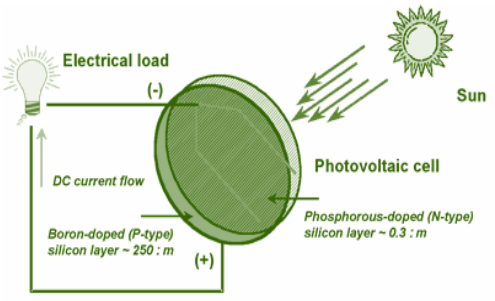
ABOUT PV TECHNOLOGY

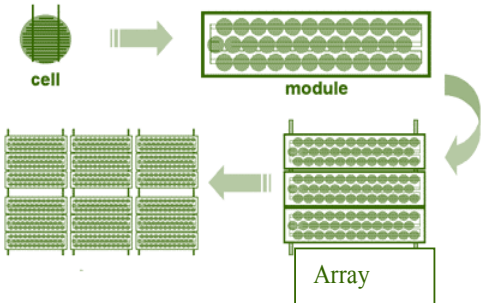
Photovoltaic technology is standardized, available, and highly reliable. Five national homebuilders are currently including PV in major residential developments throughout the Sacramento region.

Photovoltaics (PV), meaning "light electricity," is a diverse technology that converts the sun's light directly into electricity. Photovoltaic cells are small semiconductors manufactured from silicon and other conductive materials.

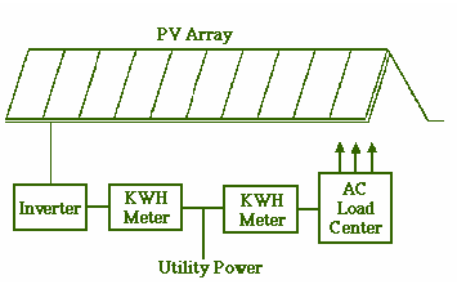
When light strikes a PV cell, electrons from the cell's negative layer flow through a circuit to its positive layer,

producing an electric current. Dozens of individual cells are arranged together to form a sealed, weatherproof module, with the capability to meet a wide variety of electrical needs, large and small. Modules can be grouped together into PV arrays, and wired through an inverter that changes the direct current (DC) produced by PV modules into alternating current (AC), making the electricity suitable for homes and business, and compatible with the electric grid.



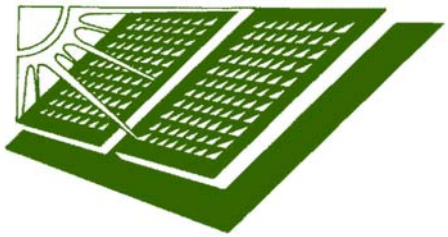


The main PV system equipment includes modules (framed plastic or glass covered silicon material coated with conductive metals) that transform sunlight into direct current electricity; and an inverter that is connected from the modules to change the PV's electric current from DC to AC as it feeds the power into a utility panel or grid.



There are grid-tied, and battery PV systems. Grid-tied systems feed the PV generated electricity through the inverters and into a power panel for direct use, with any surplus power fed back into the utility grid for credit against future kWh use. The current **net-metering** arrangement with PG&E gives equal financial credit toward future kWh use for each kWh sent into the system by the PV equipment. Grid-tied systems do not provide power if the utility power goes offline.

If there is a need to be independent from the grid, or to have back-up power for certain equipment, a battery PV system should be installed. With this system the inverter sends direct current to charge a bank of batteries. When the batteries are full the system begins sending AC to the power panel. If the utility power shuts down the batteries provide back up power to the building through the inverter.



THREE STEPS TO AN "ENERGY SMART" PROJECT

PV is a great technology to supplement an already energy efficient project. The less energy the building needs, the higher the percentage of power can be generated by the PV system.

1. Use the Sun wisely and plan for renewable power
2. Plan for efficiency and comfort
3. Analyze the kWh load from common buildings

First - use the sun wisely.

Passive solar design means minimizing east and west facing windows and shading the ones you have to reduce unwanted heating. Other simple project design elements include:

- Maximize the density of dwelling units while maximizing spaces between buildings
- Plant deciduous trees on the south side, evergreen on the east and west. Make sure the full grown trees will shade windows, but not the PV panels.
- Site a building to optimize the solar orientation and allow windows to access prevailing breezes. Give the building a longer east/west axis so that more of the windows are on the south side than other orientations. It costs little, if anything, to reposition windows and

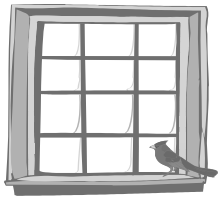
modify the orientation moderately during design. Put paving to the north side of buildings so that summer heat is not reflected or radiated into the living spaces.

- Minimize east and west-facing windows. Because of the higher summer sun angle on the south, it is easier to shade south facing windows with overhangs and trees in summertime. In the winter, south facing windows can also provide beneficial heat.
- To prepare for installation of solar technology, including PV and water heating equipment, design south facing unobstructed roof space and landscape with trees that won't shade a PV system.

Second – use the most energy efficient building materials and appliances.

New affordable housing projects have a wealth of resources for integrating energy efficiency into the building design. Existing buildings can benefit from accessing energy efficiency rebates on appliances, lighting, heating and air equipment, and window retrofits.

Seek expert advice, specific to your project, about each of the following technologies or methods:



- **Windows**

  ⇒ Low-e glass helps reduce winter losses at an additional cost of less than $100/apt (sometimes $0).

⇒ High-performance low-e glass also reduces summer heat gain for an additional cost of $10/apt (again, it can be $0).

⇒ Using high performance glass can reduce heating and cooling needs enough that you can use smaller HVAC equipment and save nearly $100/apt. The savings in HVAC equipment downsizing can completely pay for the upgrades in high-performance windows. This also makes the tenants much more comfortable.

- **High efficiency HVAC systems**

  ⇒ Maximize equipment efficiency

  ⇒ Get AC equipment with thermal expansion valves (TXVs)

  ⇒ Ensure proper duct installation and sealing

  ⇒ Size equipment correctly for the space

- **Appliances: Use ENERGY STAR®**

  ⇒ Refrigerators

  ⇒ Washers

  ⇒ Dish washers

- **Dryer – use Gas!**

- **Water**

  ⇒ Low flow toilets, shower heads, faucets

⇒ Horizontal Axis washers

⇒ For central water heating systems, add a demand sensing system that shuts off the circulation pump ANYTIME the delivered water is hot enough, this can save 10-40% of hot water energy at approximately $10/apt.

- **Lighting**

⇒ T-8s and electronic ballasts

⇒ CFLs - Compact Fluorescent Lamps

⇒ Reflector bulbs in "can" lights

⇒ Occupancy sensors

- **Whole Building Design**

⇒ Roof sheathing with an integral radiant barrier costs ~$0.08/sf more than "standard" roof sheathing (~$4000 for a 2-story 100 unit apt. building). In the Central Valley, this would save over $600/year in cooling energy; and there would be an almost immediate pay back in HVAC equipment sizing.

⇒ Integrate PV friendly roofing materials in new construction projects, and pre-plan for the system conduit with trenching and conduits along the roof line or through attics.

It is clear that the initial higher investment in high

efficiency windows, doors, pool and irrigation pumps, and appliances have short payback periods and high customer benefits. If you add the value of reduced maintenance, reduced tenant complaints, and increased property values, the payback might be measured in weeks. Maximizing efficiency also allows you to select the most cost-effective photovoltaic system. Take maximum advantage of the rebates and purchase incentives available. (e.g. PG&E, California Energy Commission, Energy Star programs.)

Third – analyze the energy profile of the common buildings and individual units.

In order to size your PV system and other solar equipment you will want to understand how much electricity your project will use.

What is the likely electricity load for each dwelling unit? For the common buildings? For landscaping and common area lighting? If previous project information is not available to make these estimates contact an energy engineer or your local utility

for average kWh demand for the type of dwelling in your area. If the project is already completed, simply analyze its energy use based on previous utility bills.

Once you know how much electricity will be needed, it is easier to gauge how much PV you want to install. In multi-family buildings and co-housing projects it is common to install and size the PV system to support

common-area uses, such as a community room, laundry room, parking lot lighting, and booster or irrigation water pumps. In single-family homes it is common to install a system that will produce 50-75% of the projected kWh use.

EXAMPLE Costs and Cash Flow: An installed PV system may cost $3-$8 per watt (after rebates.) For example, a 10,000 watt system (producing an average of 1,450 kWh per month, offsetting $232 (@.16/kWh) of electricity cost, may cost $40,000 or more after the $5/watt rebate. This estimate includes equipment, materials, installation, warranty, processing rebate applications, local permits, and the required PG&E E-NET metering agreement.

If this system produces 17,400kWh of power annually, it may save $2,784 per year in electricity cost, for a payback period of under 15 years. If the system was financed with a 30yr construction loan at 6%, the largest annual payment on the loan would be $2,400, so the cash flow from the system would be positive starting in the first year.

NON-PROFIT BUILDER WEB RESOURCES

Sustainable Industry Building Council
http://www.sbicouncil.org/workshops/index.html

Habitat for Humanity Green Building
http://www.habitat.org/env/resources.html

Ask an Energy Expert
http://www.eren.doe.gov/askanenergyexpert/

Energy Efficiency and Renewable Energy Clearinghouse (EREC)
http://www.eere.energy.gov/

Housing and Community Development – state agency
http://housing.hcd.ca.gov/ca/index.html#fac

PATH – Partnership for Advancing Technology in Housing
http://www.pathnet.org/topics/energy.html

Habitat for Humanity – energy efficiency building guidelines
http://www.habitat.org/env/resources.html

Rebuild America – energy efficiency resources
http://www.rebuild.org/sectors/public_mfh_resources.asp

Center for Resourceful Building Technology
http://www.crbt.org/

DOE – Creating Energy Smart Communities
http://www.sustainable.doe.gov/buildings/affhousing.shtml

DOE – Office of Building Technology - Solar
http://www.eren.doe.gov/buildings/build_equip.html

Building Environmental Science and Technology
http://www.nrg-builder.com/greenbld.htm

Heschong Mahone Group
http://www.designedforcomfort.com/Downloads/fact_sheets.htm

PG&E
Check for design assistance, rebates and incentive programs from: www.pge.com or www.pge.com/003_save_energy/003b_bus/index.shtml

CONSIDERING PV DURING THE DESIGN PROCESS

NOTE: Readers should check with a PV design expert on the exact timing and process for installation in their area.

This list of steps is meant to assist an organization incorporate PV into an affordable housing project. The California Energy Commission offers materials such as "Buying a PV Solar Electric System - A CONSUMERS GUIDE" and "A Guide to Photovoltaic (PV) System Design and Installation" on their website: http://www.consumerenergycenter.org/erprebate/forms

- **Concept Phase:**

  ⇒ Do the Organizational goals include energy efficiency and reducing electricity costs for residents?

  ⇒ Would renewable power help the loan and permit approval process?

  ⇒ Site analysis - Will the location benefit from PV (e.g., panel location has few trees, is shade free?)

  ⇒ Would the PV feed a common building or each unit? What is the typical energy use for this type of building or use?

  ⇒ What would the highest energy efficiency construction mean? Do a rough cost-benefit analysis)

⇒ Assess the general size and location for the system(s)

⇒ Work with a project designer that understands and supports energy efficiency and solar power

- **Predevelopment Phase:**

  ⇒ Identify size of system and site location

  ⇒ Identify sources of financing and incentives unique to PV; apply for grants and/or seek sponsorships (if applicable)

  ⇒ Finalize cost-benefit analysis and seek bid from PV contractors

  ⇒ Identify any unique zoning or permit requirements

  ⇒ Integrate PV system into architectural design

  ⇒ Integrate PV contractor into design team

- **Development Phase:**

  ⇒ Ongoing communication between PV contractor and design team; integrate PV system into design plans

  ⇒ Choose exact PV components and equipment

  ⇒ Submit financing applications

  ⇒ Submit buydown application and reservation forms (when system will be completely installed within nine months)

⇒ Assure state buydown is reserved before signing PV purchase contract

- **Construction Phase:**

  ⇒ Integrate PV system into construction (trenching; conduit; structural supports; roof mounts, etc.)

  ⇒ Apply for local permit (if required)

  ⇒ Apply for utility interconnection permit and E-NET rate agreement.

- **Operation Phase:**

  ⇒ Submit buydown rebate and receive utility permit once local permit is received.

CALCULATING WHAT AND WHERE TO INSTALL YOUR PV SYSTEM

To evaluate a proposed PV system it is useful to understand general PV system sizes, maintenance and warranty factors, and production rates for your region. The following estimates are based on using the most efficient PV module technology available (e.g. most production per square foot of module) in the Northern Central Valley region.

- **Installation**

In northern California a PV system should have a southern exposure and be tilted +/-10 degrees of latitude. The key is to angle the panels where they receive maximum sun exposure between 9am and 3pm during the longest days of the year. There are a few factors to consider when determining whether a site is appropriate for a PV installation.

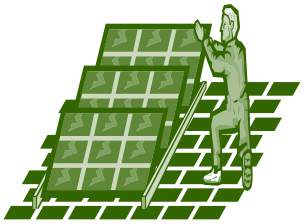
If only a western or eastern exposure is available there will be a potential loss in productivity (10-20%), however, the system may still be a valuable investment. A PV retailer can trace the sun's path for you and can provide you with production estimates at various angles and exposures.

Residential grid-tied PV projects are often installed on the roof because the roof has the least shading and it avoids occupying ground-level open space.

It is becoming more common for multi-family housing builders to install PV on parking bays and shade structures. In this way, the panels provide shade for cars, are easy to access for maintenance cleaning, and are more visible than some roof applications.

In the ideal PV project a building will be designed specifically to support PV equipment and tilted at an angle that produces the most electricity. For example, the ideal PV roof in the City of Davis is a single-story, large, uninterrupted composition roof with a 30° slope facing

due south. This angle roughly equates to a 7/12 roof pitch. A more standard 6/12 roof pitch provides a 26.5° angle, for a minor loss in productivity compared to the ideal angle. A 5/12 roof may include a PV mounting bracket that tilts the system at a steeper angle to boost productivity.



The site should be free of obstructions such as trees, mountains, and buildings that might shade the modules. Consider both summer and winter paths of the sun, as well as the growth of trees and future construction that may cause shading problems. Shading on just a portion of the PV panels may greatly reduce the output from the entire system.

Finally, the unobstructed site should also have appropriate terrain (if ground mounted) and sufficient space to install the PV system.

- **Space**

100-150 square feet of flat unshaded surface is needed for each 1KW of PV system.

- **kWh Production**

Seasonal variations and exact location have a big effect on PV output, but in California it is estimated that an average PV system will produce 145 kWh per month per 1,000 watt system (1kw).

- **System Maintenance**

Regular inspections of the system will ensure that the wiring and contacts are free from corrosion, the modules are clear of debris, and the mounting equipment has tight fasteners. Maintenance includes cleaning the panels in order to prevent dust and pollen build-up, which can significantly reduce PV output. Regular maintenance is as simple as washing the array and checking to make sure the inverter is working properly.

- **Feeding the meter**

It is easiest to have the project feed one utility meter because of the net-metering agreement and permits required from PG&E; and in order to accurately size the PV system. This may mean one system feeding the meter that supplies common-area power, or smaller systems feeding each individual home. However, it is possible to build one system that feeds many meters.

- **Warranty**

PV modules are built to perform for 30-40 years and are usually warranted to produce at least 80% of their rated power 20 years after purchase.

PV system installers in California must provide a 5-year warranty covering installation and equipment replacement. Most PV installers will process a customer panel replacement request through the manufacturer for at least the first five years of operation.

PV Design Tools on the Web

In most cases the PV installer will do all the system design and engineering work, however, builders may want to review some of the free design information on the internet in order to better communicate with the installer/contractors.

CEC - Clean Power Estimator
A valuable internet tool for estimating the costs and benefits of installing a PV system. The user can also estimate how various angles and exposures will affect PV output and payback periods.
www.consumerenergycenter.org/renewable/estimator/index.html

Kyocera Solar Estimator
http://kyocerasolar.clean-power.com/kyocerasolar/default.asp

NREL PVWATTS calculator
http://rredc.nrel.gov/solar/codes_algs/PVWATTS/

BIPV Designer
Shareware software for people interested in Building Integrated Photovoltaic (BIPV) energy and economic estimating. Phone: (530)-795-2930 Website: http://www.energyi.mccabe.net/BIPVdesigner.htm

NSOL 4.0
PV sizing program http://www.orionenergy.com

RETScreen - Photovoltaics, Weather Data, Product Data
Download software free of charge. Website: http://retscreen.gc.ca Email: rets@nrcan.gc.ca.

REBATES AND OTHER INCENTIVES

California Energy Commission Rebates

The California Energy Commission is currently providing a special fund for affordable housing projects. Current rebate level for eligible affordable housing systems is $5.00 per watt for systems installed by a hired contractor and $4.25 for owner-installed systems. Rebates will decrease on July 1, 2003.

The special state rebate funding will usually reduce the "list price" of an installed PV system by 50-60%. To learn more about the state rebate, call the Energy Call Center at 800-555-7794 or visit the website at www.consumerenergycenter.org/erprebate.

Please download the entire Guidebook from the CEC website and confirm that the special affordable housing funding is still available prior to purchasing your PV equipment. The exact language from the CEC Guidebook is included below.

See http://www.consumerenergycenter.org/erprebate/index.html for application forms, eligible systems, etc.

Excerpt from Chapter VII, B of Emerging Renewables Program Guidebook regarding special funding for affordable housing projects:

Pursuant to Assembly Bill 58 [AB 58, Keeley, (Statutes Of 2002, Chapter 836)], the Energy Commission has established an additional rebate for systems installed on

affordable housing projects. Affordable housing projects may qualify for an extra 25 percent rebate above the standard rebate level, not to exceed 75 percent of the system cost, if the following additional criteria are met:

1. The affordable housing project was undertaken pursuant to sections 50052.5, 50053, or 50199.4 of the Health and Safety Code.
2. Each residential unit (apartments, multifamily homes, etc.) has an individual meter.
3. The housing project has adopted measures to promote energy efficiency as evidenced by receipt of an energy efficiency rebate from the Energy Commission or applicable electric utility provider.

To apply for the extra rebate, owners of the affordable housing project must submit the following in addition to the standard application:

- A copy of the regulatory agreement for the property, title of the property, or equivalent documentation indicating that residency is limited to low and moderate income persons as defined by the Health and Safety Code sections 50052.5, 50053, or 50199.4.
- Documentation from the electric utility indicating that each residential unit has an individual meter.
- Documentation of energy efficiency measures already implemented to achieve at least a 10 % reduction in

electricity usage or letter indicating receipt of an energy efficiency rebate administered by the Energy Commission or applicable electric utility provider. See [www.consumerenergycenter.org] or call (800) 555-7794 for a list of rebate opportunities.

There are **financing programs** available to provide low-interest loans. See: www.consumerenergycenter.org/erprebate/financing_intro.html

Rebates for Large Commercial PV Systems

For larger PV systems (of 30KW or more) and commercial customers, there is also a $4.50 per watt rebate, administered by PG&E. For more information, visit the website at www.pge.com or call 415-973-6436.

Tax Incentives

15% State tax credit available for the net cost of the PV system. Who is Eligible for the Tax Credit?

Any residential or commercial customer who purchased and installed a solar energy system on property in California between January 1, 2001 and December 31, 2005 whose solar energy system is used to produce electricity and is primarily used to meet the taxpayer's own energy needs is eligible to take the credit. In addition, taxpayers cannot sell the electricity produced with eligible solar energy generation equipment, although they can utilize California's existing net metering law if they are eligible. See the San Diego Regional Energy Office summary of this program at:http://

www.californiasolarcenter.org/pdfs/15%25_State_Tax_Credit_Summary_SDREO.pdf

10% Federal Tax Credit is available for commercial customers. To date it is unclear that these credits are transferable to affordable housing investment partners. A summary of the credit is available from Maryland-DC-Virginia Solar Energy Industries Association (MDV-SEIA) at: http://www.mdv-seia.org/federal_incentives.htm

Both of these credits are limited to the PV system owners, and have not been found to be transferable to investors as of this writing. Customers should consult with their tax accountants regarding these credits. A summary of the credits and links to the relevant forms, including the federal accelerated depreciation provisions is found at the California Solar Center website:

http://www.californiasolarcenter.org/incentives.html
http://www.consumerenergycenter.org/rebate/index.php

TCAC Incentives

Once a TCAC award is made, the TCAC Executive Director may permit an increase in basis limits of up to 5% of the award. This increase, when awarded, may be a significant source of funding for the PV system – although the system must be part of the project plan in the first place. The relevant language from the 2003 TCAC application is included here:

TCAC benefit for PV (Post Award Credits):

"Further, the Executive Director, in his/her sole discretion, may permit a further increase in basis limits to a maximum of 5%, where distributive energy technologies such as microturbines and/or renewable energy sources such as solar will be implemented. To obtain this increase, an applicant must submit evidence of the savings to be created through the use of the technology."

California Public Utilities Commission

Grid-connected solar electric systems from a minimum of 30kW up to a maximum of 1.5MW are eligible for a one-time cash incentive of $4,500 per kW (AC) up to half of the system cost. Reservations are made through PG&E. Once installation is complete and the building permit is signed off, apply for the payment of the rebate.

Net Metering

Net metering means that when your PV system generates more power than you need, the meter runs backwards resulting in the utility paying for the electricity at the same rate it charges the customer. In essence, you receive full retail value for all the power that your PV system generates—whether it is used directly by the building or sent into the utility grid. Talk with your PV provider about the potential to maximize your PV system value

through a Time-Of-Use metering arrangement with the utility.

In order to receive full credit for your PV produced electricity you must submit a net-metering agreement application. Most PV vendors will process this agreement on your behalf, but to receive more information and the application materials you may visit http://www.pge.com/002_biz_svc/gen/standard_enet.shtml or call the Generation Interconnection hotline at (415) 972-5676 or send an e-mail to gen@pge.com.

FUNDING OPPORTUNITIES FOR ENERGY EFFICIENT, ENVIRONMENTALLY FRIENDLY AFFORDABLE HOUSING

written by: Marin County Community Development Agency, 3501 Civic Center Dr., Room 308, San Rafael, CA 94903-4157. 415-507-2659

Energy Efficiency Buildings Incentive Act (S2718)- This act of Congress on June 13, 2000 created an impressive list of incentives for green buildings. Check out www.floridagreenbuilding.org/news for the latest information.

Savings By Design- This CPUC Sponsored utility run program gives rebates of up to $150,000 to nonresidential building owners and $50,000 for the design team on projects that exceed Title 24 by 5% to 10%. Contact: www.savingsbydesign.com

Energy Saving Performance Contracts—

A performance contract can be implemented with no upfront cost to the building owners and is paid for out of the building's energy savings. The service provider, usually an "energy services company" or an ESCO, obtains the financing and assumes the performance risks associated with the project. The financing company, the ESCO, owns the energy saving or energy producing equipment (including photovoltaics) during the term of the contract and the equipment asset and debt do not appear on the balance sheet. The best part of this

arrangement is that the contract relies little on the financial strength of the building owner, but is base on the building's savings in operational costs. Contact www.naesco.org for a list of energy service companies.

PG&E Information for Affordable Housing

http://www.pge.com/001_res_svc/financial_assistance/qual_chart_care.shtml

CARE- CARE is a financial assistance program for low income homes and housing facilities. It offers a 20 percent discount on monthly energy bills. Contact: ww.pge.com; 800-743-5000.

Energy Partners Program- Energy Partners is Pacific Gas and Electric Company's free weatherization program. Utility-approved contractors work with low-income customers to make their homes more energy efficient. Contact: www.pge.com; (800) 933-9555

LIHEAP– A Federal program that provides heating and cooling financial assistance and weatherization to almost 5 million low-income households. Contact: www.csd.ca.gov/LIHEAP.htm; (916) 341-4200

Energy Program Resources

The Foundation Center- Considered the "gateway to philanthropy on the world wide web," the Center's website features an on-line research librarian subscription to a monthly database featuring the top 10,000 grant funding agencies. Check out www.fdncenter.org or call 212-620-4230.

Green Building Funding Directory- This helpful resource is full of organizations that have funding available for sustainable affordable housing projects.

Housing and Urban Development- HUD Energy Partnerships for Affordable Homes are available for energy efficiency in public housing units. The PATH program also funds innovative energy-saving technologies for commercial, community, and residential buildings that are part of a HUD- funded or otherwise funded affordable housing projects. www.hud.gov or www.pathnet.org.

Rebuild America- The Rebuild America program aims to increase the energy efficiency of commercial buildings and multi-family housing in the US. Partnerships must include at least one state or local government member, as well as businesses, educational institutions, and nonprofits. Partners are eligible for grants, specialized energy loans, business tax credit programs, pre-arranged financing, and money back guarantees for performance contracting audits. Check out www.eren.doe.gov/building/rebuild.

Million Solar Roofs Initiative– A US DOEs initiative that provides financing for photovoltaic and solar hot water systems. Contact Ruth Adams at 303-275-4788 or visit www.millionsolarroofs.org.

Energy Saver Partnership Program- Volume Purchase Program- This program brings together manufactures and buyers to facilitate the best prices on volume purchases of high performance appliances and building equipment. For

more information contact Graham Parker, Pacific Northwest National Laboratory. 509-375-3805.

Many foundations and governmental agencies offer grants for energy efficiency and green building projects. Please see these resources for financial assistance.

Grant Opportunities

California Energy Commission- The CEC is offering several funding opportunities for energy efficient and renewable energy projects. Check out www.energy.ca.gov/contracts.

US Department of Energy– The US DOE has several grant opportunities listed at www.energy.gov.

Center of Excellence for Sustainable Development – CESD– Offers great links to funding opportunities provided by the federal government. www.sustainable.doe.gov, 800-357-7732.

Buildings and Community Systems Research and Development Grants – This program focuses on integrated community energy issues. Check out www.er.doe.gov; 202-586-0098.

Climate Trust – This foundation provides grant funding (more than $5M is available) for energy efficiency and renewable energy projects that reduce carbon dioxide and other green house gas emissions. Check out www.climatetrust.org; 503-238-1915.

Energy Foundation– This foundation promotes energy efficiency and renewable energy through grants awarded in 5 areas: 1) Energy-efficient utility 2) Energy efficient buildings 3) transportation 4) Renewable energy 5) Integrated Issues. Check out www.energy foundation.org or call 415-561-6700.

EPA Technology for a Sustainable Environment Grant – The EPA invites research grant applications in 5 topic areas. Funding amounts and application due dates vary by topic. Check out www.epa.gov/ncerqa.

Fannie Mae Foundation– The goal of this foundation is to support national and local non-profit organizations that are working to provide decent and affordable housing and vital neighborhoods. The Foundation distributes at least $24M annually in Community Outreach grants. Check out www.fanniemaefoundation.org or call 202-274-8000.

Kirsch Foundation– This foundation is interested in air quality, global warming and clean energy. Check out www.kirschfoundation.org

MacArthur Foundation– This foundation offers grants focusing on human and community development. Check out www.macfdn.org.

Rockefeller Brothers Fund-This foundation addresses the issue of climate change by focusing on utility-based energy efficiency, renewable energy, transportation, and green taxes. Check out www.rbf.org or call 212-812-4200.

Shell Foundation – This group of companies recently created a new $30 million foundation to help fund sustainable energy and other social investment projects. Check out www.shellfoundation.org.

Surdna Foundation– This foundation funds projects focused on the environment and community revitalization. Check out www.surdna.org or call 212557-0010.

GLOSSARY

[from City of Arcata (arcatacityhall.org/energy/energyprogram.html) PV booklet written by the Renewable Energy Development Institute REDI (redinet.org)

- **Kilowatt (kW)** – Basic unit of measuring electricity consumption or generation – equals one thousand watts – the equivalent of ten 100 watt light bulbs or the amount of sunlight falling on one square meter on a sunny summer day at noon

- **Kilowatt-hour (kWh)** – One-thousand watts of electricity consumed or generated in a one hour period

- **Grid-connected** – Electricity is provided to a home or business by the electric utility through the power lines, or the "grid"

- **Interconnection** – Electrical customers may now generate electricity at their location from solar electric systems serving loads on site and feeding excess electricity back into the grid through a grid-connected meter.

- **Net Metering** – The process allowing electric consumers to be credited for electrical power generated at their location at the same rate that the utility charges. On an annual basis an electricity customer can furnish some or all of their electricity, however the utility is not required to pay for or credit any excess electricity beyond a customer's annual bill.

- **Direct Current (DC)** – The type of electricity generated by the solar electric array and many other renewable energy technologies.

- **Alternating Current (AC)** – The type of electricity created by the electric utility and used in homes and businesses for most electrical appliances

- **Electric Load** - The amount of electrical power (in watts or kilowatts) consumed by electrical devices.

- **Photovoltaic (PV) modules**-Device that converts the energy of the sun into electrical energy.

Photovoltaic array- A group of PV modules wired together in an array.

PV CASE STUDY

East Bay Habitat for Humanity to Install PV

www.californiasolarcenter.org source: release 2003.3.6
East Bay Habitat for Humanity embarks on remarkable project to equip 26 homes with their own solar electric system sized to provide all the electricity each family will need.

East Bay Habitat for Humanity (EBHFH), a non-profit residential housing developer, announced today that it will begin construction in 2003 on 26 housing units with solar electric systems designed to provide most if not all of each low-income family's annual electricity needs. According to Lisa Boege of EBHFH, the 26 homes, to be placed on in-fill lots in Oakland and nearby Livermore, will each have a 2.22 kW solar electric system on their rooftops, and will be grid-connected to Pacific Gas and Electric, the area's electric utility, as part of EBHFH's newly developed "Green Habitat Project".

Discounts on solar electric equipment as well as technical and program management assistance are being provided by Fred Klaske of Sky Power Systems, a solar electric systems provider in Castro Valley, CA. Each EBHFH solar electric system will consist of 12 Sharp 185 Watt modules wired into an SMA SunnyBoy 2500 inverter, and will be attached to the asphalt shingle roof using Uni-Rac mounting hardware. These solar electric systems are expected to save each of the 26 families in this "Green Habitat Project" nearly $500 per year in reduced electric bills.

While much of the overall expense is being reduced by generous discounts on material and labor as well as the California Energy Commission (CEC) rebate program, EBHFH is actively soliciting donations to cover the remaining $133,000 ($5,100 per unit) cost of this "groundbreaking" PV project. EBHFH, a leading Habitat for Humanity International affiliate, has built over 70 homes

in the past 15 years using volunteer labor and donations of money and materials.

Contributions to East Bay Habitat for Humanity for the "Green Habitat Project" should be mailed to EBHFH at 2619 Broadway, Suite 215, Oakland, CA 94612. Information about the "Green Habitat Project" can be found on the web at EBHFH's website at http://www.eastbayhabitat.org or by calling 510-251-6304. Sky Power Systems can be reached at http://www.skypowersystems.com or 510-727-9640 for more information on the solar electric technology being used.

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February 25, 2003 FAX (510) 251-6309
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